

# Frozen Raw Foods as Skin-Testing Materials

## Further Studies of Use in Cases of Allergic Disorders

GIACOMO R. ANCONA, M.D., and IRWIN C. SCHUMACHER, M.D., San Francisco

RESULTS WITH THE USE of frozen raw foods as skin-testing materials in subjects with allergic disorders were reported in 1950.<sup>1</sup> Fifty-one foods had been selected as representing the important members of the zoological and botanical groups commonly used in the authors' locality. Each food was collected in the fresh raw state and, according to its physical properties, was reduced to a paste or powder suitable for scratch testing. The material was placed in shell vials of 2 cc. capacity, closed with clean stoppers and immediately stored in a freezing compartment. From this frozen stock, complete sets of the different foods were subsequently assembled into units. A few minutes before the tests were to be made, the unit was removed from the freezer, and the material was permitted to thaw at room temperature. Scratch tests were performed, employing one-tenth normal sodium hydroxide or one-fiftieth normal sodium hydroxide with 30 per cent glycerin as a moistening agent. Remnants of the test materials were discarded at the end of each day's work.

Comparative scratch tests of frozen foods and one or more commercial extracts were made in 66 subjects, the majority of whom had allergic diseases of various types. In 43 of the subjects, the reactions were entirely negative, indicating that the raw foods were non-urticariogenic. Observations, based on over 3000 scratch tests, convinced the authors that these frozen raw materials applied in this manner were harmless to the patients.

In a group of 23 subjects who had positive or doubtful reactions to one or more foods with either the frozen raw materials or the commercial extracts, the raw foods produced true positive reactions of a larger size and in greater frequency than the corresponding commercial extracts.

During the past three years frozen raw food pastes and powders have been used routinely as testing materials in patients suspected of sensitivity to foods. The original list has been increased to 111 foods to include more representatives of the important zoological and botanical groups in common use. In addition to the materials on this basic list for

*• In further studies on the use of frozen raw food as skin-testing material in patients with allergic disorders, the results of previous work were confirmed in a greater number of subjects using a larger number of foods:*

*Tests with frozen raw foods by the scratch method induce true positive reactions of a larger size and in greater frequency than the corresponding commercial extracts by either the scratch or the intracutaneous method.*

*Storage in the frozen state for several years does not affect the antigenic potency of the materials. The frozen preparations have caused no harmful effects in the subjects, are free from irritant properties, and are not urticariogenic.*

routine testing, various others have been prepared for use in special instances when the history suggested sensitivity to some food not on the basic list or to check closely related foods in the various groups.

The foods that have been used routinely in the studies made since the first report in 1950 are listed in Table 1.

The method of preparation has remained unchanged. It should be emphasized, however, that experience has shown that for certain raw foods there is an optimum amount of grinding and blending sufficient to produce a smooth paste, without causing separation of the material into solid and liquid portions.

The length of time the raw materials retain their antigenic properties when maintained in the frozen state has been investigated. At various intervals, comparative tests have been made of foods prepared and frozen four years ago with similar foods freshly prepared, using subjects known to give positive reactions. It was found in every instance that the frozen raw foods that had been kept as long as four years showed no appreciable loss of antigenic potency.

In 345 new patients, on whom approximately 34,000 tests were made, no harmful effects were noted. Thus, as in the previous study, these frozen raw materials were found to be entirely innocuous to the subjects. Furthermore, in a group of 218

Presented before the Section on Allergy at the 82nd Annual Session of the California Medical Association, Los Angeles, May 24-28, 1953.

From the Allergy Clinic, the Department of Medicine, the School of Medicine, University of California, San Francisco.

**TABLE 1.—Foods used routinely in studies of skin-testing with allergens prepared by freezing**

|              |              |               |            |
|--------------|--------------|---------------|------------|
| Beef         | Artichoke    | Cottonseed    | Banana     |
| Lamb         | Beet         | Eggplant      | Olive      |
| Pork         | Spinach      | Paprika       | Coconut    |
| Milk, Cow    | Lettuce      | Pepper, Green | Date       |
| Chicken      | Sweet Potato | Potato        | Apple      |
| Egg, Chicken | Broccoli     | Tomato        | Pear       |
| Anchovy      | Cabbage      | Carrot        | Raspberry  |
| Bass         | Horseradish  | Celery        | Strawberry |
| Cod          | Mustard      | Dill          | Grapefruit |
| Halibut      | Radish       | Parsley       | Lemon      |
| Tuna         | Cantaloupe   | Peppermint    | Orange     |
| Salmon       | Cucumber     | Sage          | Currant    |
| Sardine      | Squash       | Vanilla       | Grape      |
| Smelt        | Watermelon   | Clove         | Cashew     |
| Sole         | Zucchini     | Poppyseed     | Hazelnut   |
| Crab         | Yam          | Pepper, Black | Chestnut   |
| Lobster      | Mushroom     | Curry         | Pecan      |
| Shrimp       | Yeast        | Ginger        | Walnut,    |
| Clam         | Bean, Lima   | Pineapple     | English    |
| Oyster       | Bean, Navy   | Almond        | Brazil Nut |
| Oat          | Bean, Soy    | Apricot       | Pine Nut   |
| Barley       | Bean, String | Cherry        | Hops       |
| Rye          | Licorice     | Peach         | Coffee     |
| Wheat        | Pea          | Prune         | Cocoa      |
| Corn         | Peanut       | Cranberry     | Tea        |
| Rice         | Asparagus    | Avocado       | Flaxseed   |
| Buckwheat    | Garlic       | Cinnamon      | Honey      |
| Rhubarb      | Onion        | Fig           | Tapioca    |

patients on whom some 20,000 tests were done, completely negative reactions were obtained, again indicating that these materials do not contain irritants capable of producing false reactions. The non-specific erythematous reactions occasionally noted with spinach, mustard and eggplant were readily recognized as such.

During the past three years tests with frozen raw foods have been made on 345 subjects with various allergic disorders. In 50 of them who had negative reactions and in five with positive reactions, no comparative studies were made with commercial extracts.

In the remaining 290 subjects the reactions to scratch tests with frozen raw foods were compared with results obtained with commercial extracts used in three ways: (1) scratch test, (2) both scratch and intracutaneous tests, and (3) intracutaneous test only. One hundred sixty-eight of the subjects had entirely negative reactions to the frozen raw foods by scratch test and to the commercial extracts by the scratch or the intracutaneous test, or both.

One hundred twenty-two subjects showed positive or doubtful reactions to at least one of the 108 foods by scratch test with frozen raw foods or commercial preparations. Neither kind of preparation of rhubarb, clove or pear caused any reaction in the subjects tested. The results are summarized in Table 2. The total number of reactions to frozen raw foods was 882 (655 positive, 227 doubtful), as against 567 (275 positive, 292 doubtful) by the same subjects to commercial extracts. In 203 instances, the reaction to a frozen raw food was negative when

**TABLE 2.—Comparative results of scratch tests with frozen raw foods and with commercial extracts in 122 patients who had positive or doubtful reactions to one or more of 108 foods**

|            |               | Type of Reaction |          |           |
|------------|---------------|------------------|----------|-----------|
|            |               | Positive         | Doubtful | Negative* |
| Frozen     | Material..... | 655              | 227      | 203       |
| Commercial | Extract.....  | 275              | 292      | 518       |

\*Includes those instances in which reaction was negative to either the frozen raw food or commercial extract when positive or doubtful with the other.

**TABLE 3.—Comparative results of scratch tests of frozen raw foods and intradermal tests of commercial extracts in 58 patients who had positive or doubtful reactions to one or more of 87 foods**

|            |                | Type of Reaction |          |           |
|------------|----------------|------------------|----------|-----------|
|            |                | Positive         | Doubtful | Negative* |
| Frozen     | Material.....  | 201              | 71       | 43        |
| Commercial | Extracts†..... | 52               | 63       | 200       |

\*Includes those instances in which reaction was negative to either the frozen raw food or commercial extract when positive or doubtful with the other.

†Commercial extracts which produced positive reactions by scratch test are not included in this group.

the reaction to a commercial extract was positive or doubtful, whereas the converse was true in 518 instances. This preponderance of positive reactions with frozen raw foods is in agreement with the results reported in 1950.

Fifty-eight patients had negative reaction to scratch tests with commercial extracts of 87 foods, but had positive or doubtful reaction to either the scratch test with frozen raw food or the intracutaneous test with commercial extracts. The results of this comparative study are summarized in Table 3. The total number of reactions to frozen raw foods by scratch test was 272 (201 positive, 71 doubtful), as against 115 (52 positive, 63 doubtful) by the same subjects to commercial extracts by intracutaneous test. In 43 instances the reactions to the frozen raw food were negative when the reactions to the commercial extracts were positive or doubtful, whereas in 200 instances the converse was true. These figures indicate the superiority of the scratch test with frozen raw materials over the intracutaneous test with the corresponding commercial extracts.

In the original report a comparison of the size of the reactions to the frozen raw foods and to the commercial extracts by the scratch method was made, using a grading system of points in which doubtful reactions received a value of 0.5 and positive reactions 1 to 4, the value depending upon the degree of reaction. On this basis there were (in the original report) 344.5 points for the frozen raw food as against 143 for the commercial extracts—indicating a predominantly larger size for the former.

This same comparison was made by one of the authors (G. A.) in 37 of the group of the previously mentioned 58 patients reported upon in Table 3. As shown in Table 4, these 37 patients had positive or doubtful reactions to one or more of 58 foods

**TABLE 4.—Comparative results of scratch tests with frozen raw foods and intracutaneous tests with commercial extracts in 37 subjects who had positive or doubtful reactions to one or more of 58 foods**

| Foods                    | Instances of Reactions | Reactions to Frozen Materials |          |           | Points† | Reactions to Commercial Extracts* |          |           |         |
|--------------------------|------------------------|-------------------------------|----------|-----------|---------|-----------------------------------|----------|-----------|---------|
|                          |                        | Positive                      | Doubtful | Negative‡ |         | Positive                          | Doubtful | Negative‡ | Points‡ |
| 1. Milk .....            | 3                      | 3                             | —        | —         | 8       | 3                                 | —        | —         | 6       |
| 2. Bass .....            | 2                      | 2                             | —        | —         | 4       | —                                 | —        | 2         | —       |
| 3. Cod .....             | 1                      | —                             | 1        | —         | 0.5     | —                                 | —        | 1         | —       |
| 4. Halibut .....         | 2                      | 1                             | 1        | —         | 1.5     | —                                 | —        | 2         | —       |
| 5. Salmon .....          | 3                      | 3                             | —        | —         | 3       | —                                 | —        | 3         | —       |
| 6. Sardine .....         | 1                      | 1                             | —        | —         | 3       | —                                 | —        | 1         | —       |
| 7. Sole .....            | 5                      | 3                             | 1        | 1         | 5.5     | 1                                 | —        | 4         | 2       |
| 8. Tuna .....            | 4                      | 4                             | —        | —         | 9       | —                                 | 1        | 3         | 0.5     |
| 9. Crab .....            | 10                     | 8                             | 2        | —         | 22      | 1                                 | —        | 9         | 4       |
| 10. Lobster .....        | 3                      | 3                             | —        | —         | 5       | —                                 | 1        | 2         | 0.5     |
| 11. Shrimp .....         | 8                      | 8                             | —        | —         | 18      | 3                                 | 2        | 3         | 6       |
| 12. Clam .....           | 10                     | 10                            | —        | —         | 23      | 1                                 | 2        | 7         | 2       |
| 13. Oyster .....         | 2                      | 1                             | —        | 1         | 1       | —                                 | 1        | 1         | 0.5     |
| 14. Barley .....         | 3                      | 1                             | —        | 2         | 2       | 3                                 | —        | —         | 5       |
| 15. Wheat .....          | 1                      | 1                             | —        | —         | 3       | —                                 | —        | 1         | —       |
| 16. Corn .....           | 1                      | —                             | 1        | —         | 0.5     | —                                 | —        | 1         | —       |
| 17. Rice .....           | 2                      | 2                             | —        | —         | 2       | —                                 | 1        | 1         | 0.5     |
| 18. Buckwheat .....      | 1                      | —                             | 1        | —         | 0.5     | —                                 | 1        | —         | 0.5     |
| 19. Mustard .....        | 4                      | 4                             | —        | —         | 6       | —                                 | —        | 4         | —       |
| 20. Sprout .....         | 1                      | 1                             | —        | —         | 3       | —                                 | —        | 1         | —       |
| 21. Cantaloupe .....     | 1                      | 1                             | —        | —         | 1       | —                                 | —        | 1         | —       |
| 22. Squash .....         | 1                      | 1                             | —        | —         | 2       | 1                                 | —        | —         | 2       |
| 23. Mushroom .....       | 2                      | 2                             | —        | —         | 2       | —                                 | —        | 2         | —       |
| 24. Lima bean .....      | 9                      | 8                             | 1        | —         | 19.5    | —                                 | —        | 9         | —       |
| 25. Navy bean .....      | 2                      | 2                             | —        | —         | 4       | 1                                 | —        | 1         | 2       |
| 26. Soy bean .....       | 4                      | 4                             | —        | —         | 11      | 2                                 | —        | 2         | 2       |
| 27. String bean .....    | 1                      | —                             | 1        | —         | 0.5     | —                                 | —        | 1         | —       |
| 28. Pea .....            | 5                      | 2                             | 3        | —         | 7.5     | 1                                 | —        | 4         | 2       |
| 29. Peanut .....         | 10                     | 6                             | 3        | 1         | 14.5    | 3                                 | —        | 7         | 8       |
| 30. Garlic .....         | 2                      | 2                             | —        | —         | 3       | —                                 | 1        | 1         | 0.5     |
| 31. Onion .....          | 1                      | —                             | 1        | —         | 0.5     | —                                 | —        | 1         | —       |
| 32. Potato .....         | 1                      | 1                             | —        | —         | 1       | 1                                 | —        | —         | 4       |
| 33. Tomato .....         | 1                      | 1                             | —        | —         | 1       | —                                 | —        | 1         | —       |
| 34. Caraway .....        | 1                      | 1                             | —        | —         | 4       | —                                 | —        | 1         | —       |
| 35. Carrot .....         | 1                      | —                             | —        | 1         | —       | —                                 | 1        | —         | 0.5     |
| 36. Celery .....         | 1                      | —                             | 1        | —         | 0.5     | —                                 | 1        | —         | 0.5     |
| 37. Dill .....           | 2                      | 1                             | 1        | —         | 4.5     | —                                 | 1        | 1         | 0.5     |
| 38. Parsley .....        | 2                      | —                             | 1        | 1         | 0.5     | —                                 | 2        | —         | 1       |
| 39. Curry .....          | 1                      | 1                             | —        | —         | 1       | —                                 | —        | 1         | —       |
| 40. Pineapple .....      | 1                      | —                             | 1        | —         | 0.5     | —                                 | —        | 1         | —       |
| 41. Almond .....         | 2                      | 1                             | 1        | —         | 1.5     | —                                 | —        | 2         | —       |
| 42. Apricot .....        | 1                      | —                             | 1        | —         | 0.5     | —                                 | —        | 1         | —       |
| 43. Peach .....          | 2                      | 2                             | —        | —         | 5       | —                                 | —        | 2         | —       |
| 44. Avocado .....        | 1                      | 1                             | —        | —         | 1       | —                                 | —        | 1         | —       |
| 45. Fig .....            | 1                      | 1                             | —        | —         | 3       | —                                 | —        | 1         | —       |
| 46. Banana .....         | 1                      | —                             | 1        | —         | 0.5     | 1                                 | —        | —         | 2       |
| 47. Coconut .....        | 1                      | —                             | 1        | —         | 0.5     | —                                 | —        | 1         | —       |
| 48. Date .....           | 1                      | 1                             | —        | —         | 1       | —                                 | —        | 1         | —       |
| 49. Orange .....         | 1                      | —                             | —        | 1         | —       | 1                                 | —        | —         | 1       |
| 50. Hazelnut .....       | 6                      | 3                             | 2        | 1         | 5       | 2                                 | 1        | 3         | 6.5     |
| 51. Black walnut .....   | 3                      | 2                             | 1        | —         | 2.5     | —                                 | —        | 3         | —       |
| 52. English walnut ..... | 5                      | 3                             | 2        | —         | 6       | 1                                 | —        | 4         | 1       |
| 53. Pine nut .....       | 1                      | 1                             | —        | —         | 2       | —                                 | 1        | —         | 0.5     |
| 54. Hops .....           | 1                      | 1                             | —        | —         | 1       | —                                 | —        | 1         | —       |
| 55. Coffee .....         | 2                      | 1                             | 1        | —         | 1.5     | —                                 | —        | 2         | —       |
| 56. Cocoa .....          | 2                      | 1                             | 1        | —         | 1.5     | —                                 | —        | 2         | —       |
| 57. Flaxseed .....       | 1                      | 1                             | —        | —         | 3       | —                                 | —        | 1         | —       |
| 58. Honey .....          | 2                      | 2                             | —        | —         | 3       | 1                                 | —        | 1         | 1       |
| Totals .....             | 150                    | 110                           | 31       | 9         | 236.5   | 27                                | 17       | 106       | 63.5    |

\*Commercial extracts which produced positive reactions by scratch test are not included in this group.

†Includes those instances in which reaction was negative to either the frozen food or commercial extract when positive or doubtful with the other.

‡"Points" are based on a value of 0.5 for a doubtful positive and 1 to 4 for the positive, the value depending upon the degree of reaction—1 plus to 4 plus.

**TABLE 5.—Comparative incidence in 122 patients of positive and doubtful reactions to scratch tests with frozen raw materials and to scratch or intracutaneous tests with commercial extracts according to food groups**

|              | Reaction to Frozen Raw Materials |          | Reaction to Commercial Extracts |          |
|--------------|----------------------------------|----------|---------------------------------|----------|
|              | Positive                         | Doubtful | Positive                        | Doubtful |
| Fish*        | 112                              | 24       | 21                              | 38       |
| Crustaceans† | 111                              | 11       | 24                              | 18       |
| Molluscs‡    | 40                               | 8        | 9                               | 12       |
| Cereals§     | 74                               | 24       | 51                              | 37       |
| Beans¶       | 112                              | 35       | 43                              | 37       |
| Nuts         | 57                               | 31       | 26                              | 19       |

\* Anchovy, bass, cod, halibut, salmon, sardine, smelt, sole, tuna.

† Crab, lobster, shrimp.

‡ Clam, oyster.

§ Oat, barley, rye, wheat, corn, rice, buckwheat.

¶ Lima bean, navy bean, soy bean, string bean, pea, peanut.

|| Hazelnut, chestnut, hickory nut, pecan, black walnut, English walnut, Brazil nut, pine nut.

by scratch test with frozen raw materials or by intracutaneous test with commercial extracts, or by both. Using the same system of grading, there were 236.5 points for the frozen raw food, as against 63.5 points for the commercial extracts—again indicating the predominantly larger size of the reactions for the former.

The results shown in Tables 3 and 4 indicate that frozen raw foods as skin-testing materials by the scratch method induce reactions of a larger size and in greater frequency than do the corresponding

commercial extracts by the intracutaneous method.

Throughout the course of this study the authors were impressed by the incidence of positive reactions to commonly eaten foods of certain zoological and botanical groups. A comparative study was made of the occurrence of the reactions elicited by the scratch method with frozen material and with commercial extracts in the groups of fish, crustaceans, molluscs, cereals, legumes and nuts. As shown in Table 5, it is apparent that the frozen raw foods in these groups produced a significantly greater number of positive reactions than did the commercial extracts. Milk, egg, and potato, not included in Table 5, produced approximately the same number of reactions with the two different types of material.

2000 Van Ness Avenue.

#### ACKNOWLEDGMENT

The authors wish to acknowledge with thanks the technical help of Miss Frances Eliggi, R.N., and Miss Betty Pollock, B.A., M.T. (ASCP).

#### REFERENCE

1. Ancona, G. R., and Schumacher, I. C.: The use of raw foods as skin testing material in allergic disorders, Calif. Med., 73:473-475, Dec. 1950.